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(71) Applicant(s)
Patrick Brogan
Loughside Engineering Company, Skeboy Road, Loughmacrory, OMAGH, Co Tyrone, BT79 9LG, United Kingdom

(72) Inventor(s)
Patrick Brogan

(74) Agent and/or Address for Service
Patrick Brogan
Loughside Engineering Company, Skeboy Road, Loughmacrory, OMAGH, Co Tyrone, BT79 9LG, United Kingdom

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(56) Documents Cited
GB 0847337 A GB 0405314 A EP 0537797 A1
US 4486309 A US 4226717 A

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(54) A bucketwheel sand washer with submerged recovered fine aggregate transporter

(57) A bucketwheel sandwasher wherein the recovered fine aggregate transporter in the settling channel is submerged so that its movement does not agitate or disturb the flowing water. The submerged transporter may be a screw conveyor 3 or a multi-bladed scraper (17, Fig. 2) mounted on a frame (18) reciprocated by rams (19) and guided in elevated return movement over pivoted cams (21).

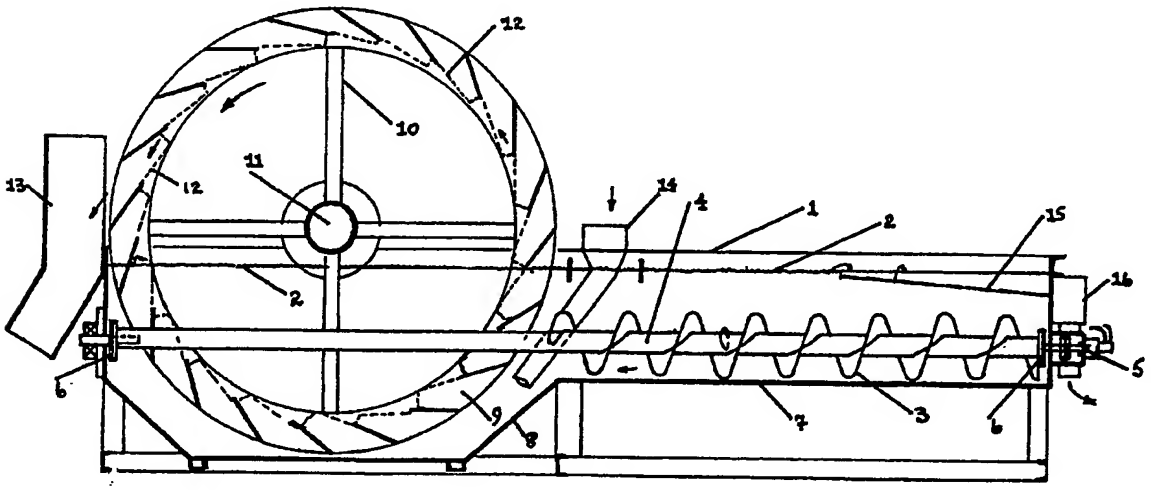

Fig. 1.

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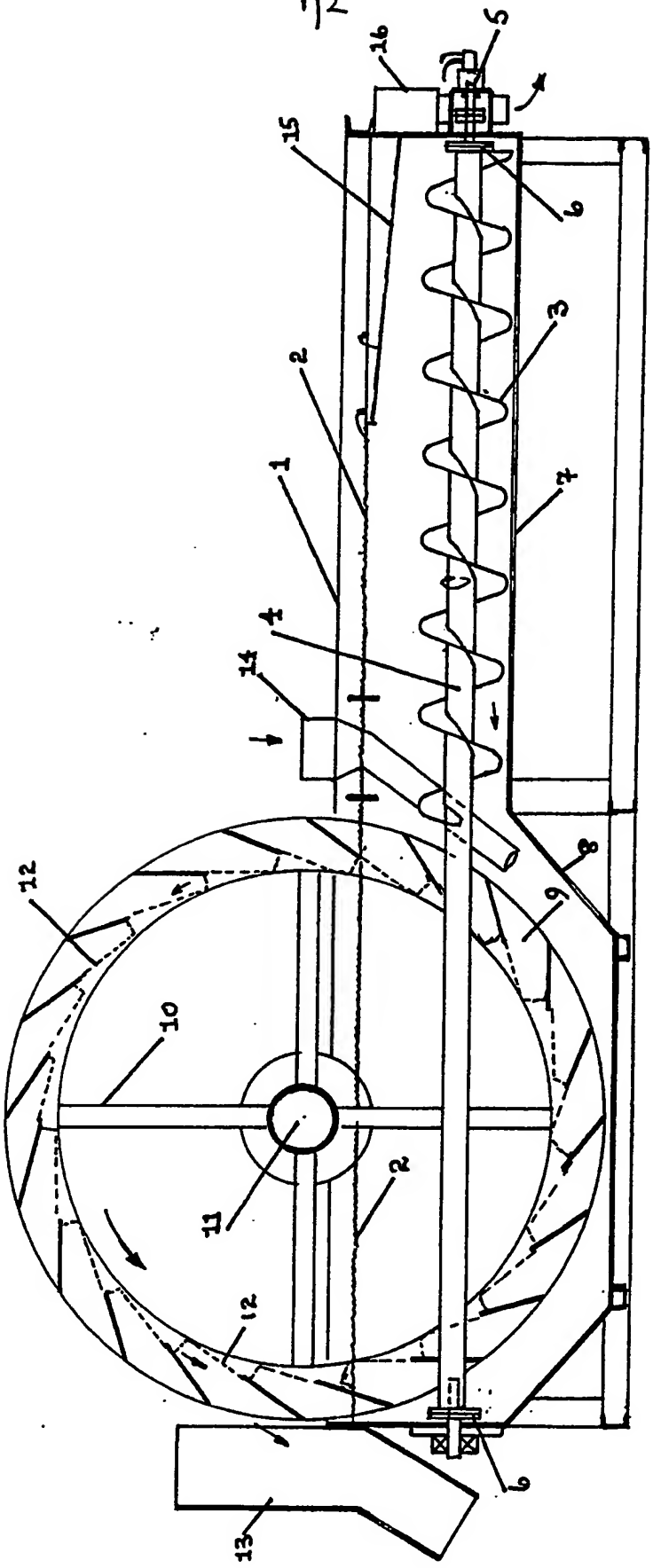

FIG. 1.

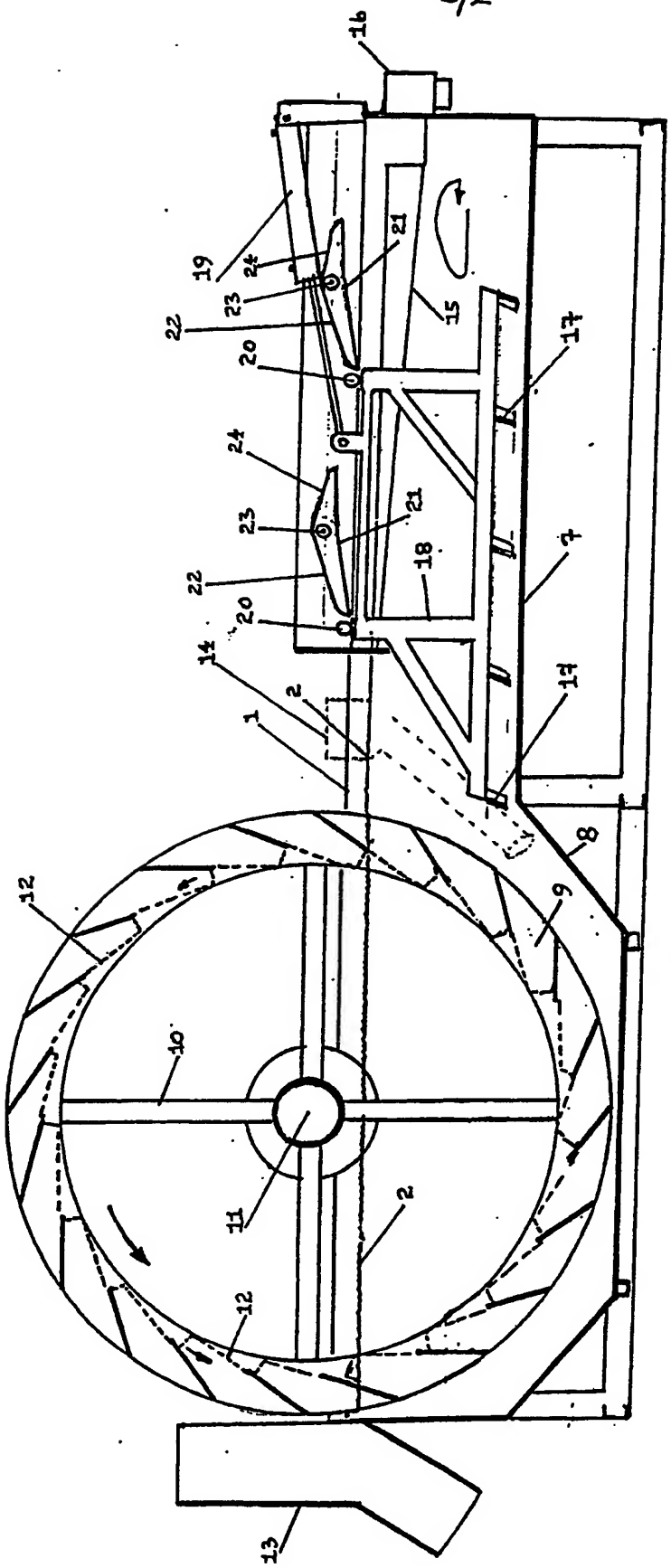
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FIG.2.

SAND OR FINE AGGREGATE DEWATERING MACHINE .

This invention relates to a sand dewatering machine for use in sand or fine aggregate washing plants. Sand washing and dewatering plants are ubiquitous in the concrete and construction industries and are necessary so that soluble salts, colloidal clays and ultra-fine silicates can be removed from raw sand,or other fine natural aggregates,before use in concrete and mortar mixes or as dry fillers in asphaltic cements. When raw fine aggregate,such as sand,is excavated it has its particle interstices filled with colloidal or semi-colloidal clays and these serve to consolidate the mineral in the ground and to hold it in a non-drift condition; but when it is washed free of these materials the interstices become partly filled with air and water and the resulting angle of repose is sufficient to allow the product to be stockpiled. There is a large difference between the apparent densities of silica sands and the silt or semi-colloidal clays which invariably occur as deposit,or pit,contaminants,so it is not surprising to find that sand washing plants exploit this difference in order to separate this silt from the sand. This effect,which is called sand-washing,is achieved by mixing the raw fine aggregate with flowing water and fluming off the silt to yield an almost clay-free product (washed sand) which thereafter can be stockpiled for sal and d spatch to the site of usag . The most common type of sand washer is that constructed around a "bucket-wheel" where a mixture of sand,silt and water flows into a tank and the sand

is collected by a rotary bucket-wheel where within each bucket, of which there is a series placed around the circumference of the wheel, there is an area of mesh or perforations which allow the water to drain back into the tank and then, about 270° later, the orientation of the buckets allows the washed sand to discharge by gravity into a collection chute. The system is such that for damp washed sand to be discharged after three quarters of a revolution of the wheel the perforations have to be of sufficient size to allow the drainage water to fall into the tank somewhat quickly with the result that silt and some of the very fine sand passes down with it. This causes an increase in the waste from the process and shortens the sedimentation life of the settling ponds with the additional costs involved in cleaning-out operations. To give a proper grading to the already washed sand it is preferable that the sand fines, but not the silt, be separated and re-combined with the sand to achieve this preferable sieve analysis. To ensure better recovery of the sand fines the machines of the prior art have been designed with helical screw conveyors positioned in the settling tank with their drive shafts positioned above the water level. As this screw conveyor rotates the suspended, but gravitating, fines move towards the waste discharge end of the tank and eventually settle on the floor where they fall into the path of the screw conveyor, as the silt and water passes on, and are continually conveyed back along the tank bottom and into the path of the rising discharge buckets. In this type of design it is also useful to have waste water weirs in the tank so as to reduce the water volume and velocity over any given

point in the flow system thus r ducing the influenc f water flow on fines migration. With the greater part of the described screw conveyor projecting above the water level the design of current machines places serious constraints on the positioning of weirs and makes for a limiting factor on the length and position f the weirs. Also because the screw conveyor is not submerged its blades leave the water on one side and enter it on the other thus continually disturbing the water and interfering with desirable sedimentation. These described disadvantages are overcome in the present invention where there is provided a bucket-wheel sandwasher which incorporates a recovered fines transporter in the form of either a totally submerged screw conveyor or a submerged milti-bladed scraper housed in the washer's settling tank or channel. Specific embodiments of the invention will now be described by way of example with reference to the accompanying drawings inwhich:-

Figure 1 shows a sectional side elevation of the bucket-wheel washer and screw conveyor in the sandwasher's settling tank.

Figure 2 shows a sectional side elevation of the bucket-wheel washer and multi-bladed scraper in the sandwasher's settling tank.

In the first embodiment of Figure 1 the sand or fine aggregate dewatering machine comprises a settling tank 1,with water working level 2,inwhich there is mounted a a helical screw 3 which is rotated on its shaft 4 by a hydraulic motor 5 and where all are kept in alignment by the two watertight bearings 6. Th conveyor screw 3

is alm st in parallel conta t with the bottom 7 of the settling tank 1 and is capable of moving the settled fine sand particles al ng the tank to the downward slope 8 and thence to the rising product discharge buckets 9 of the bucket-wheel washer unit 10. In the bucket-wheel 10 compartment there is a mixture of sand, silt and water and all are kept in a state of agitation by the bucket-wheel which rotates on its non-submerged shaft 11 and as a consequence of this the buckets 9, with their mesh or perforated metal parts 12,lift up the sand during the wheel's anti-clockwise rotation and thereafter allow the water and silt to flow out of each lifted aliquot of sand so that washed drained sand can be discharged to the product chute 13. As product is discharged from the bucketwheel the concentrtion of sand particles is maintained,for continuous washing operation,by feedstock of raw sand and water via the inlet chute 14. This addition of raw sand as a mobile slurry results in a rise of water level and the unit would tend to overflow if it were not for the presence of a weir 15 which is placed in such a position that it guides the excess wash-water to a discharge box 16 but it is of such a shape that it keeps the water below it in a quiescent state so that the ultrs-fine sand or aggregate particles are not disturbed or roused on their way countercurrently in the channel towards the slope 8. The hydraulic motors which drive the buckwheel and the screw conveyor are of a type which can offer wide range variable sp ed contr l to suit the parameters of any plant and any type of mineral aggregate feed. Because the screw conveyor is below the working

water level it is now possible to convey the fines towards the bucketwheel area without disturbing the outflowing water surface and sinc the surface of the tank is now open and free it is possible to place weirs at any position since all will be out of contact with the rotating screw. In the second embodiment of Figure 2 a similiar scheme for submerged or underwater fine sand transportation is employed in the form of a multi-bladed scraper 17 which moves on the floor 7 of the settling and which is carried on a frame 18 which can be pushed forward,or retracted,along the floor 7 by means of a pair of hydraulic rams 19(only one shown in Figure 2) which pushes settled sand(that less than 150 microns particle size)forward to the slope 8 and is then returned at the end of the stroke by the action of the second ram 19. It is important that the scraper 17 is not pulled back to its original starting position by a simple pulling action along the floor 7 as this would tend to pull back some of the already forwarded sand so in order to avoid this mal-practice the scraper frame 18 is fitted with cam follower bearings 20 which,on the backward stroke of the other ram 19,rises onto and rides across the top surface of the cams or rockers 21. These rockers are shaped with a long arm 22 on the left hand side of the fulcrum 23 and a shorter arm 24 to the right hand side of this fulcrum. Because of the weight difference between the long and short arms of the cams the cams will always fall freely into the positions shown in Figure 2. This means that on the backward stroke the cam foll wer 20 rides over the cams on the top surface of 22 and falls down the top surface of 24 and afterwards the

scraper motion stops and the cams fall into quilibrium with gravity with the end 22 pointing downwards. As the next str ke of the scraper starts the end 24 will be pointing upwards and as the frame 18 moves forward its cam follower does not engage the cams and therefore it moves forward in scraper contact with the floor 7 and therefore moves sand towards the bucketwheel compartment whilst the excess water and suspended silt passes over the weir 15 and out to a settling pond via the discharge box 16. In both embodiments with the working surfaces of the transporters in the settling tank fully submerged the potential to increase weir area can be utilised according to the needs of individual applications and in higher fines concentrations,or increased water volumes,or flow rates,an increased weir length will lead to greater efficiency of fine particles recovered.

In most fine aggregate washing plants it is found that non-silt sand particles of size less than 150 microns settle readily to the floor 7 of the settling tank in less than one minute so that the embodiment of Figure 2 operates very efficiently if one times the actuation of the rams 19 so that after one push and return of the scraper 17 there is a rest of about one minute before the second scraping operation begins.

CLAIMS

1.A bucketwheel sand washer which incorporates a recovered fines transporter in the form of either a totally submerged screw conveyor or a submerged multi-bladed scraper housed in the washer's settling tank or channel.

2.A bucketwheel sand washer as in Claim 1 wherein the multi-bladed scraper transports the fine aggregate,which has settled in the channel,forward into the washer's sump by direct contact motion on the floor of the sedimentation channel but which lifts off the channel floor on its return journey to the end of the channel,but yet remains submerged.

3.A bucketwheel sand washer as in Claim 2 wherein the return journey of the scraper in an elevated position,still submerged,is accomplished by causing the scraper carrier frame to follow the contours of shaped cams.

4.A bucketwheel sand washer as in Claim 3 wherein the cams are boomerang shaped with ne arm longer than the other so that when pivoted at a central point the cam will always come to equilibrium with the longer or heavier arm pointing downwards.

5.A bucketwheel sand washer as in Claims 1 to 4 wherein the movement of the fine aggregate scraper frame is accomplished by means of one or more hydraulic rams.

6.A bucketwheel sand washer as in Claims 1 to 5 wherein the forward movement of the scraper frame towards the bucketwh el sump takes place against the floor of the settling channel and without contact with the shaped cams.

7.A buck twheel sand washer as in Claim 1 wherein the ends of the submerg d screw conveyor runs in totally enclosed waterproof bearing at each end f the screw shaft so that rotation occurs freely and by means of a speed controlled hydraulic motor.

8.A bucketwheel sand washer as in any of the above Claims wherein appropriately spaced weirs are fitted to the outflow channel because the submerged fine aggregate transporters leave the surface of the outflowing water free from all obstructions.

9.A bucketwheel sand washer substantially as described herein with reference to Figures 1 and 2 of the accompanying drawings.

Patents Act 1977
Examiner's report to the C ller under Section 17 -9-
(The Search report)

Application number
[redacted]412834.5

Relevant Technical Fields

(i) UK Cl (Ed.M) B1D (DPDC,DPDD,DPDX,DPLD)

(ii) Int Cl (Ed.5) B01D 21/04, 21/24

Search Examiner
MR G J W RUSSELL

Date of completion of Search
13 SEPTEMBER 1994

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASES:WPI

Documents considered relevant following a search in respect of Claims :-
1-9

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 847337	(DEKA) see page 2 lines 9-46	1,8,9
X	GB 405314	(DELFOSSE) see page 1 lines 81-87	1
X	EP 0537797 A1	(HUBER) see Figure 2 and screw conveyor (19)	1
X	US 4486309	(KRODEL) see column 1 lines 36-60	1,2
X	US 4226717	(MALM) see column 3 lines 43-56 and Figure 3	1,2

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).